

In the Claims:

Claims 1-36 (Canceled).

37. (Currently amended) A system for reducing the coherence of a wavefront-emitting laser radiation, ~~in particular~~ for a projection objective in semiconductor lithography, a first partial beam of the laser beam impinging on a surface of a resonator body being partially reflected and a second partial beam of said laser beam entering the resonator body and emerging from the resonator body again after a plurality of total reflections at least approximately in the region of the entrance location and being forwarded with the first partial beam jointly to an illumination plane, the resonator body being formed in such a way that in addition to the splitting into partial beams, the wavefronts and at least one partial beam are modulated during a laser pulse, the partial beams which are reflected at the resonator body and which enter the resonator body being superimposed downstream of the resonator body, and the resonator body being provided with a phase plate having varying local phase distribution, wherein the phase plate has different thicknesses for the passage of the second partial beam of the laser beam transversely with respect to the beam direction, the different thicknesses of the phase plate varying in the transverse direction in a width s; and

wherein the variations in the width s are of the order of magnitude of the spatial coherence length of the laser radiation at the entrance plane.

38. (Previously presented) The system as claimed in claim 37, wherein the differences in thickness are between 200 and 500 nm.

Claim 39 (Canceled).

40. (Currently amended) The system as claimed in claim 39 37, wherein the following holds true for the value of width s lies between 0.05 mm and 1 mm. : 0.05 < s < 1 mm.

41. (Previously presented) The system as claimed in claim 37, wherein the phase plate is formed as a diffractive optical element (DOE) which is optimized to the zeroth order of diffraction.

42. (Previously presented) The system as claimed in claim 37, wherein a diffusing screen is provided as the phase plate.

43. (Previously presented) The system as claimed in claim 37, wherein the resonator body is formed as a prism having at least five corners.

44. (Previously presented) The system as claimed in claim 37, wherein the angles of reflection in the resonator body are at least 37 degrees.

45. (Previously presented) The system as claimed in claim 37, wherein the optical path length of the second partial beam in the resonator body is a multiple of the coherence length.

46. (Currently amended) The system as claimed in claim 37, wherein the light impinging on the resonator body is split in a ~~ratio of range of ratios from about~~ 1:3 to about 2:3 with respect to the first reflected partial beam and the second partial beam circulating in the resonator body.

47. (Previously presented) The system as claimed in claim 37, wherein at wavelengths of the laser beam of 157 nm or less, calcium fluoride is used as the resonator body.

48. (Previously presented) The system as claimed in claim 47, wherein calcium fluoride is chosen in a crystal orientation such that the first (100) crystal plane forms an angle of 45 degrees with the plane of the surface on which the laser beam impinges, and is perpendicular to a side face, the second (100) crystal plane being parallel to said side face.

49. (Previously presented) The system as claimed in claim 37, wherein the polarization direction of the laser beam impinging on the resonator body can be rotated relative to the plane of incidence for the purpose of setting a polarization state.

50. (Previously presented) The system as claimed in claim 49, wherein the degree of polarization is adjustable between unpolarized and linearly polarized.

51. (Previously presented) The system as claimed in claim 50, wherein a lambda/2 plate is used for setting the polarization state.

52. (Previously presented) The system as claimed in claim 43, wherein the prism is formed in symmetrical fashion.

53. (Previously presented) The system as claimed in claim 52, wherein the prism is provided with at least one asymmetrical side.

54. (Previously presented) The system as claimed in claim 37, wherein the position of the centroid beam of the laser beam impinging on the resonator body is eccentric.

55. (Previously presented) The system as claimed in claim 37, wherein the resonator body is formed in asymmetrical fashion, and in that the centroid beam of the laser beam impinges eccentrically on the resonator body.

56. (Previously presented) The system as claimed in claim 37, wherein the surface of the resonator body on which the laser beam impinges is provided with a splitter layer in such a way that it influences the entrance angle of the partial beam entering the resonator body.

57. (Previously presented) The system as claimed in claim 56, wherein the splitter layer has a varying thickness.

58. (Previously presented) The system as claimed in claim 56, wherein the splitter layer is formed in non-homogeneous fashion.

59. (Previously presented) The system as claimed in one of claims 56, 57 or 58, wherein the splitter layer has a dielectric layer.

60. (Currently amended) A projection exposure apparatus for semiconductor lithography with a laser as a light source, an illumination system, an illumination plane with a mask and with a projection objective, in which case, for reducing the coherence of a wavefront-emitting laser radiation, the laser beam impinging on a surface of a resonator body is partially reflected with a first partial beam, and a second partial beam of said laser beam entering the resonator body and emerging from the resonator body again after a plurality of total reflections at least approximately in the region of the entrance location and being forwarded with the first partial beam jointly to an illumination plane, the resonator body being formed in such a way that in addition to the splitting into partial beams, the wavefronts of at least one partial beam are modulated during a laser pulse, the partial beams which are reflected at the resonator body and which enter the resonator body being superimposed downstream of the resonator body, wherein the resonator body is provided with a phase plate having varying local phase distribution, the phase plate having different thicknesses for the passage of the second partial beam of the laser beam transversely with respect to the beam direction, the different thicknesses of the phase plate varying in the transverse direction in a widths width s; and
wherein the variations in the width s are of the order of magnitude of
the spatial coherence length of the laser radiation at the entrance plane.

Claim 61 (Canceled).

62. (Previously presented) The projection exposure apparatus as claimed in claim 60, wherein the phase plate is formed as a diffractive optical element (DOE) which is optimized to the zeroth order of diffraction.

63. (Previously presented) The projection exposure apparatus as claimed in claim 60, wherein a diffusing screen is provided as the phase plate.

64. (Previously presented) The projection exposure apparatus as claimed in claim 60, wherein the resonator body is formed as a prism having at least five corners.

65. (Previously presented) The projection exposure apparatus as claimed in claim 60, wherein the optical path length of the second partial beam in the resonator body is a multiple of the temporal coherence length.

66. (Previously presented) The projection exposure apparatus as claimed in claim 60, wherein at wavelengths of the laser beam of 157 nm or less, calcium fluoride is used as the resonator body.

67. (Previously presented) The projection exposure apparatus as claimed in claim 60, wherein the prism is formed in asymmetrical fashion.

68. (Previously presented) The projection exposure apparatus as claimed in claim 60, wherein the position of the centroid beam of the laser beam impinging on the resonator body is eccentric.

69. (Previously presented) The projection exposure apparatus as claimed in claim 60, wherein the surface of the resonator body on which the laser beam impinges is provided with a splitter layer in such a way that it influences the entrance angle of the partial beam entering the resonator body.

70. (Previously presented) The projection exposure apparatus as claimed in claim 69, wherein the splitter layer has a varying thickness and/or is formed a non-homogenous fashion.

71. (Previously presented) The projection exposure apparatus as claimed in claim 69 or 70, wherein the splitter layer has a dielectric layer.

72. (New) A system for reducing the coherence of a wavefront-emitting laser radiation for a projection objective in semiconductor lithography, a first partial beam of the laser beam impinging on a surface of a resonator body being partially reflected and a second partial beam of said laser beam entering the resonator body and emerging from the resonator body again after a plurality of total reflections at least approximately in the region of the entrance location and being forwarded with the first partial beam jointly to an illumination plane, the resonator body being formed in such a way that in addition to the splitting into partial beams, the wavefronts and at least one partial beam are modulated during a laser pulse, the partial beams which are reflected at the resonator body and which enter the resonator body being superimposed downstream of the resonator body, and the resonator body being provided with a phase plate having varying local phase distribution, wherein the phase plate has different thicknesses for the passage of the second partial beam of the laser beam transversely with respect to the beam direction, the different thicknesses of the phase plate varying in the transverse direction in a width s ; and

wherein a diffusing screen is provided as the phase plate.

73. (New) A system for reducing the coherence of a wavefront-emitting laser radiation for a projection objective in semiconductor lithography, a first partial beam of the laser beam impinging on a surface of a resonator body being partially reflected and a second partial beam of said laser beam entering the resonator body and emerging from the resonator body again after a plurality of total reflections at least approximately in the region of the entrance location and being forwarded with the first partial beam jointly to an illumination plane, the resonator body being formed in such a way that in addition to the splitting into partial beams, the wavefronts and at least one partial beam are modulated during a laser pulse, the partial beams which are reflected at the resonator body and which enter the resonator body being superimposed downstream of the resonator body, and the resonator body being provided with a phase plate having varying local phase distribution, wherein the phase plate has different thicknesses for the passage of the second partial beam of the laser beam transversely with respect to the beam direction, the different thicknesses of the phase plate varying in the transverse direction in a width s ;

wherein the resonator body is formed as a prism having at least five corners; and

wherein the prism is formed in symmetrical fashion.

74. (New) The system as claimed in claim 73, wherein the prism is provided with at least one asymmetrical side.

75. (New) A system for reducing the coherence of a wavefront-emitting laser radiation for a projection objective in semiconductor lithography, a first partial beam of the laser beam impinging on a surface of a resonator body being partially reflected and a second partial beam of said laser beam entering the resonator body and emerging from the resonator body again after a plurality of total reflections at least approximately in the region of the entrance location and being forwarded with the first partial beam jointly to an illumination plane, the resonator body being formed in such a way that in addition to the splitting into partial beams, the wavefronts and at least one partial beam are modulated during a laser pulse, the partial beams which are reflected at the resonator body and which enter the resonator body being superimposed downstream of the resonator body, and the resonator body being provided with a phase plate having varying local phase distribution, wherein the phase plate has different thicknesses for the passage of the second partial beam of the laser beam transversely with respect to the beam direction, the different thicknesses of the phase plate varying in the transverse direction in a width s ; and

wherein the position of the centroid beam of the laser beam impinging on the resonator body is eccentric.

76. (New) A system for reducing the coherence of a wavefront-emitting laser radiation for a projection objective in semiconductor lithography, a first partial beam of the laser beam impinging on a surface of a resonator body being partially reflected and a second partial beam of said laser beam entering the resonator body and emerging from the resonator body again after a plurality of total reflections at least approximately in the region of the entrance location and being forwarded with the first partial beam jointly to an illumination plane, the resonator body being formed in such a way that in addition to the splitting into partial beams, the wavefronts and at least one partial beam are modulated during a laser pulse, the partial beams which are reflected at the resonator body and which enter the resonator body being superimposed downstream of the resonator body, and the resonator body being provided with a phase plate having varying local phase distribution, wherein the phase plate has different thicknesses for the passage of the second partial beam of the laser beam transversely with respect to the beam direction, the different thicknesses of the phase plate varying in the transverse direction in a width s ; and

wherein the resonator body is formed in asymmetrical fashion, and in that the centroid beam of the laser beam impinges eccentrically on the resonator body.

77. (New) A system for reducing the coherence of a wavefront-emitting laser radiation for a projection objective in semiconductor lithography, a first partial beam of the laser beam impinging on a surface of a resonator body being partially reflected and a second partial beam of said laser beam entering the resonator body and emerging from the resonator body again after a plurality of total reflections at least approximately in the region of the entrance location and being forwarded with the first partial beam jointly to an illumination plane, the resonator body being formed in such a way that in addition to the splitting into partial beams, the wavefronts and at least one partial beam are modulated during a laser pulse, the partial beams which are reflected at the resonator body and which enter the resonator body being superimposed downstream of the resonator body, and the resonator body being provided with a phase plate having varying local phase distribution, wherein the phase plate has different thicknesses for the passage of the second partial beam of the laser beam transversely with respect to the beam direction, the different thicknesses of the phase plate varying in the transverse direction in a width s ; and

wherein the surface of the resonator body on which the laser beam impinges is provided with a splitter layer in such a way that it influences the entrance angle of the partial beam entering the resonator body.

78. (New) The system as claimed in claim 77, wherein the splitter layer has a varying thickness.

79. (New) The system as claimed in claim 77, wherein the splitter layer is formed in non-homogeneous fashion.

80. (New) The system as claimed in one of claims 77, wherein the splitter layer has a dielectric layer.

81. (New) A system for reducing the coherence of a wavefront-emitting laser radiation for a projection objective in semiconductor lithography, a first partial beam of the laser beam impinging on a surface of a resonator body being partially reflected and a second partial beam of said laser beam entering the resonator body and emerging from the resonator body again after a plurality of total reflections at least approximately in the region of the entrance location and being forwarded with the first partial beam jointly to an illumination plane, the resonator body being formed in such a way that in addition to the splitting into partial beams, the wavefronts and at least one partial beam are modulated during a laser pulse, the partial beams which are reflected at the resonator body and which enter the resonator body being superimposed downstream of the resonator body, and the resonator body being provided with a phase plate having varying local phase distribution, wherein the phase plate has different thicknesses for the passage of the second partial beam of the laser beam transversely with respect to the beam direction, the different thicknesses of the phase plate varying in the transverse direction in a width s ; and

wherein the light impinging on the resonator body is split in a range of ratios from about 1:3 to about 2:3 with respect to the first reflected partial beam and the second partial beam circulating in the resonator body.

82. (New) A projection exposure apparatus for semiconductor lithography with a laser as a light source, an illumination system, an illumination plane with a mask and with a projection objective, in which case, for reducing the coherence of a wavefront-emitting laser radiation, the laser beam impinging on a surface of a resonator body is partially reflected with a first partial beam, and a second partial beam of said laser beam entering the resonator body and emerging from the resonator body again after a plurality of total reflections at least approximately in the region of the entrance location and being forwarded with the first partial beam jointly to an illumination plane, the resonator body being formed in such a way that in addition to the splitting into partial beams, the wavefronts of at least one partial beam are modulated during a laser pulse, the partial beams which are reflected at the resonator body and which enter the resonator body being superimposed downstream of the resonator body, wherein the resonator body is provided with a phase plate having varying local phase distribution, the phase plate having different thicknesses for the passage of the second partial beam of the laser beam transversely with respect to the beam direction, the different thicknesses of the phase plate varying in the transverse direction in a width s ; and

wherein a diffusing screen is provided as the phase plate.

83. (New) A projection exposure apparatus for semiconductor lithography with a laser as a light source, an illumination system, an illumination plane with a mask and with a projection objective, in which case, for reducing the coherence of a wavefront-emitting laser radiation, the laser beam impinging on a surface of a resonator body is partially reflected with a first partial beam, and a second partial beam of said laser beam entering the resonator body and emerging from the resonator body again after a plurality of total reflections at least approximately in the region of the entrance location and being forwarded with the first partial beam jointly to an illumination plane, the resonator body being formed in such a way that in addition to the splitting into partial beams, the wavefronts of at least one partial beam are modulated during a laser pulse, the partial beams which are reflected at the resonator body and which enter the resonator body being superimposed downstream of the resonator body, wherein the resonator body is provided with a phase plate having varying local phase distribution, the phase plate having different thicknesses for the passage of the second partial beam of the laser beam transversely with respect to the beam direction, the different thicknesses of the phase plate varying in the transverse direction in a width s ; and

wherein the prism is formed in asymmetrical fashion.

84. (New) A projection exposure apparatus for semiconductor lithography with a laser as a light source, an illumination system, an illumination plane with a mask and with a projection objective, in which case, for reducing the coherence of a wavefront-emitting laser radiation, the laser beam impinging on a surface of a resonator body is partially reflected with a first partial beam, and a second partial beam of said laser beam entering the resonator body and emerging from the resonator body again after a plurality of total reflections at least approximately in the region of the entrance location and being forwarded with the first partial beam jointly to an illumination plane, the resonator body being formed in such a way that in addition to the splitting into partial beams, the wavefronts of at least one partial beam are modulated during a laser pulse, the partial beams which are reflected at the resonator body and which enter the resonator body being superimposed downstream of the resonator body, wherein the resonator body is provided with a phase plate having varying local phase distribution, the phase plate having different thicknesses for the passage of the second partial beam of the laser beam transversely with respect to the beam direction, the different thicknesses of the phase plate varying in the transverse direction in a width s ; and

wherein the position of the centroid beam of the laser beam impinging on the resonator body is eccentric.

85. (New) A projection exposure apparatus for semiconductor lithography with a laser as a light source, an illumination system, an illumination plane with a mask and with a projection objective, in which case, for reducing the coherence of a wavefront-emitting laser radiation, the laser beam impinging on a surface of a resonator body is partially reflected with a first partial beam, and a second partial beam of said laser beam entering the resonator body and emerging from the resonator body again after a plurality of total reflections at least approximately in the region of the entrance location and being forwarded with the first partial beam jointly to an illumination plane, the resonator body being formed in such a way that in addition to the splitting into partial beams, the wavefronts of at least one partial beam are modulated during a laser pulse, the partial beams which are reflected at the resonator body and which enter the resonator body being superimposed downstream of the resonator body, wherein the resonator body is provided with a phase plate having varying local phase distribution, the phase plate having different thicknesses for the passage of the second partial beam of the laser beam transversely with respect to the beam direction, the different thicknesses of the phase plate varying in the transverse direction in a width s ; and

wherein the surface of the resonator body on which the laser beam impinges is provided with a splitter layer in such a way that it influences the entrance angle of the partial beam entering the resonator body.

86. (New) The projection exposure apparatus as claimed in claim 85, wherein the splitter layer has a varying thickness and/or is formed a non-homogenous fashion.

87. (New) The projection exposure apparatus as claimed in claim 85, wherein the splitter layer has a dielectric layer.